UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OCT 29 1980

OFFICE OF ENFORCEMENT

MEMORANDUM

SUBJECT: BASF Wyandotte Corporation

FROM: J.R. Murphy JRM

TO: Dennis Devlin

The comments relevant to hydrogeology, so far, are:

1. The depth of fill in the site does range from approximately 3 feet in the N.W. corner to over 14 feet and is unknown for the entire length of the site along the river, except in the vicinity of DMF5. There it appears to be 12.5 ft. FIG 4.

2. According to several sources limestone underlies the area at a depth variably reported as 40-60 ft. This fact needs to be confirmed and a description of the limestone given, i.e. porous, fractured, faulted, karstic, etc. Attitudes should be supplied.

3. Attachment B - Why does the overlay of the zone of contaimination extend into the Detroit River? Did the landfill at one time lie where the channel is today? What are the characteristics of well #17. Is it an actively pumping well, monitoring well, or what? Groundwater flow appears by one interpretation to be flowing SE toward #17 and NW, also toward #17, from the east. Why is point 17 called a well on the map and a "pit" less than 4 ft. deep on p. 15? See Sketch 1.

4. There are also some indications of a limited recharge of the site from the southwest at the large curve in the West Jefferson avenue and parking lot.

5. D&M report - p.4. Did the clay range in depth to 32.0 ft. or was the hole terminated in clay at 32.0 ft?

6. Hvorslev's methodology is acceptable, however a field falling head test (FFH) is usually limited to pervious and/or saturated soils only. Therefore any portion of the data base derived in unsaturated soils should be omitted. Hvorslev's technique also measures K_h (horizontal permeability) as opposed to K_v (vertical permeability) as found by the lab falling head test. If precautions were taken to prevent this discrimination they were not noted. The literature often makes reference to the fact that the lab test gives results up to 10^3 greater than the FFH.

7. Page 6 - Hazen's Formula is: $K = 100\ D^2_{10}$ this approximation works best with granular, permeable soils and decreases in accuracy going toward clays. It tends to be most accurate with sands and silts. Further the argument can be given that it measures K_h.

8. Page 7 - The possibility of on ancestral Mangaugan Creek could be of significance to this case. Other data have indicated its presence northeast of DMF 4. This possibility and the increasing depth of fill going toward DMF 4 requires resolution. The percentage of coarse material increases going eastward, as well.

9. Page 9 - The statement of D&M that the subsurface water in the fill is in "communication" with the river is true and enforces the case of US EPA.

10. Calculated Values and Data Base

a. As all the math works best with saturated samples, values for unsaturated soils were omitted in our calculations.

b. Use of the geometric mean is a judgemental call and not really needed; especially since it skewed the data toward the low side.

c. K_v and K_h data can be separately used in calculations to obtain quantity and time with very different results.

d. There is no permeability data for the SM (silty-sand mixture) horizon next to the river at DMF 3,4 and 5. The underlying silt layer was only investigated full depth at DMF 5. Therefore, no one really knows what the K_h is along the river.

e. According to AER's report a Zone of Contamination can be drawn onto the plat. Scaling this area onto the sketch's of D&M the deepest fill and the lowest potentiometric surface both plot in the center of the area. One boundary line is very close to DMF 4. This needs investigation. If the potentiometric surface at DMC 3 is not an error, or the surface did not have time to rise to its proper level then a drop of 19.7 ft. (gradient = 0.136) is indicated. This is of great variance from the normal range for the site.

f. There is no fill isopach for DMF 3 and DMF 4 Fig. 3

g. An alternate Fig. 5 potentiometric surface sketch can be derived.

h. An alternate Fig. 4, topographic surface of the fill clay interface can be drawn. This one more dramatically illustrates the possibility of the ancestral creek and exhibits more Channelization. Note also that the "channel" leads to the contamination zone and exits the site just north of DMF 4.

11. Recalculation D&M data and formulae Ave of FFH & H2 (minus unsaturated) permeabilities. (See Attachment A.)

12. Summary

A. The data from D&M are not adequate to remove doubt of contamination off-site.

B. D&M report states that the site is "in communication with the river."

C. No data were submitted concerning the underlying bedrock.

D. A map study discloses a deep quarry one mile south of the site which has water problems. There could be a link between the site and the quarry. Samples need to be taken.

E. The computed t (time) factors using Q = kia exhibit that from 2.3 to 41 years would be required for the first slug of contaminants to reach the river. The site has been in use since 1951, therefore adequate time has passed for the release of contaminants.

F. No regional well inventory was prepared nor was it exempted.

"Attachment II"

II. v^2 calculation – D & M data and formula.
ave. of PFH & H2 (minus weathered) permeabilities
$Kh_1 = 6.2 \times 10^{-4}$ cm/sec
ave of PFH permeabilities only (minus weathered)
$Kh_2 = 3.2 \times 10^{-5}$ cm/sec

$V_1 = \frac{Kh_1 \text{(gradient)}}{n} = \frac{6.2 \times 10^{-4} (.011)}{.422} = 1.6 \times 10^{-5}$ cm/sec

$= \underline{16 \text{ ft/yr.}}$

$V_2 = \frac{Kh_2 \text{(gradient)}}{n} = \frac{3.2 \times 10^{-5} (.011)}{.422} = 8.5 \times 10^{-7}$ cm/sec

$= \underline{0.8 \text{ ft/yr.}}$

$Q_1 = 1.6 \times 10^{-5}$ cm/sec $\times$ 820 m^2 = $\underline{1.3 \times 10^{-4}\ m^3/sec}$

$Q_2 = 8.5 \times 10^{-7}$ cm/sec $\times$ 820 m^2 = $\underline{7.0 \times 10^{-6}\ m^3/sec}$

Use of the Kh_2 values yields answers similar to D & M. Given the volume 9.3 × 10⁶ liters and the area of exit postulated by D & M, which is not proven, the exit could be more channelized, with a higher permeability and greater flow. Or it could be spread over a greater area. The data at present are inadequate.

t = time
V = volume
v = velocity
A = area = 820 m^2

$t_1 = \frac{V}{A} \div v_1 = \frac{9.3 \times 10^{\text{[illegible]}}\ cm^3}{8.2 \times 10^6\ cm^2} \div 8.5 \times 10^{-7}$ cm/sec

$= 1.3 \times 10^9$ sec $= \underline{41.2 \text{ yrs.}}$

$t_2 = \frac{V}{A} \div v_1 = \frac{\text{[illegible]}\ cm^3}{8.2 \times 10^6\ cm^2} \div 1.6 \times 10^{-5}$ cm/sec

$.71 \times 10^8$ [illegible] $= 2.3$ yrs.

11 (cont)

Using another approach to the problem of the flow and time the following values are obtained

$Q = k i a$

$Q_1 = 6.2 \times 10^{-4}\ cm/sec \times .011 \times 820\ m^2$

$= \underline{55.9\ cm^3/sec} = \underline{4.3\ m^3/day} = \underline{1268\ gal/day}$

$Q_2 = k_2 i a$

$= 3.25 \times 10^{-5}\ cm/sec \times .011 \times 820\ m^2 = 2.9\ cm^3/sec$

$= .25\ m^3/day$

$= \underline{66\ gals/day}$

If D & M data are used in same formulae would yield:

$Q = 2.0 \times 10^{-5}\ cm/sec \times .011 \times 820\ m^2$

$= 0.16\ m^3/day = 42\ gal/day$

12. Summary

A. The data from D & M are not adequate to remove doubt of contamination off-site.

B. D & M report states that the site is "in communication with the river."

C. No data were submitted concerning the underlying bedrock.

D. [redacted] quarry ~ one mile south of the site which has water problems. There could be a link between the site and the quarry. Samples need to be taken.

E. The computed (time) factors using $Q = KIA$ exhibit that from 2.3 to 48 years would be required for the first slug of contaminant to reach the river. The site has been in use since 1951, therefore a sufficient time period for the (lateral) spread of contaminants.

F. The [illegible] well [illegible] [illegible]

Sketch 1

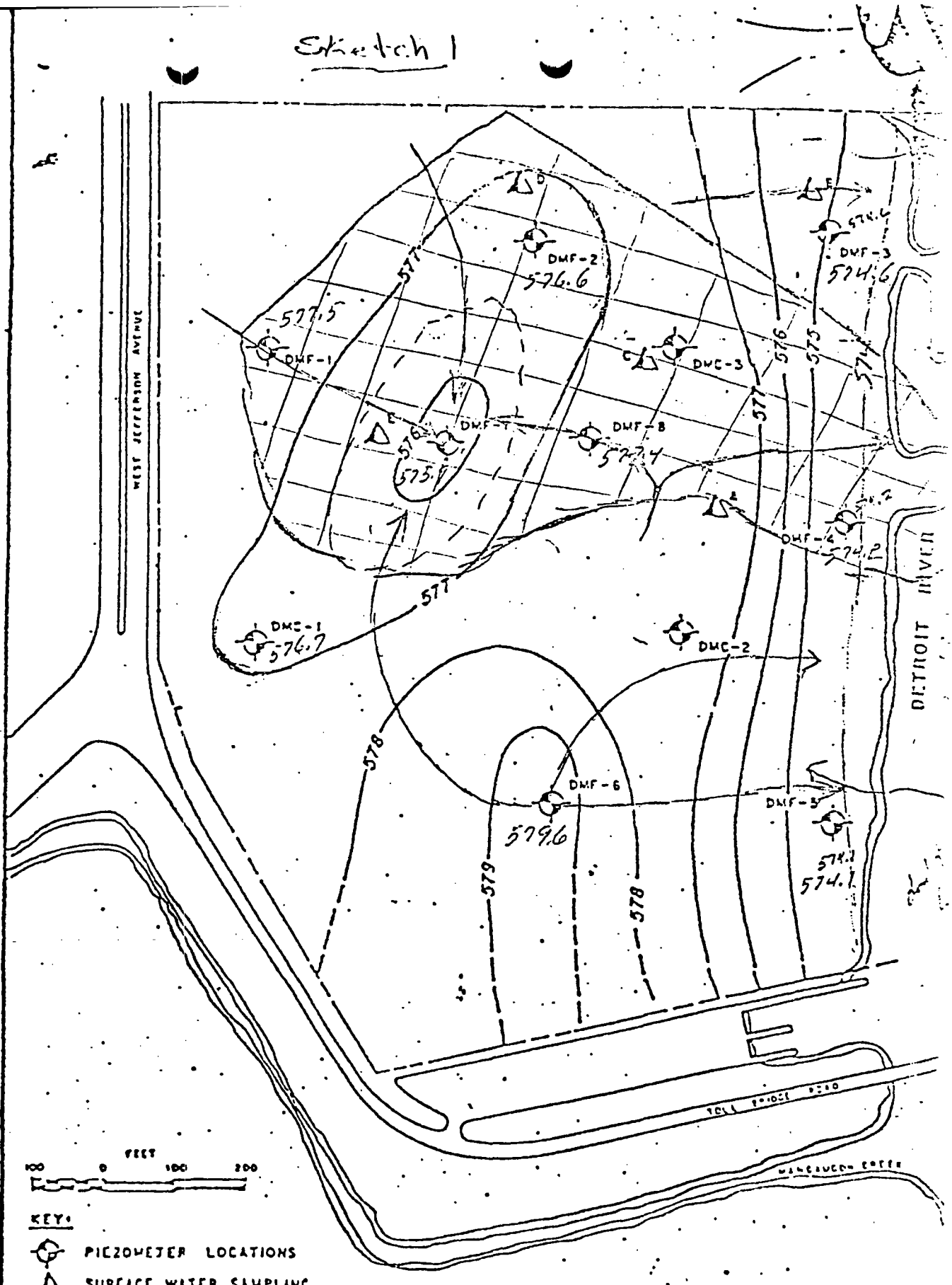

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FIGURE 5
POTENTIOMETRI
SURFACE (MARCH,
DAMES & M

Possible Direction of Ground Water Flow

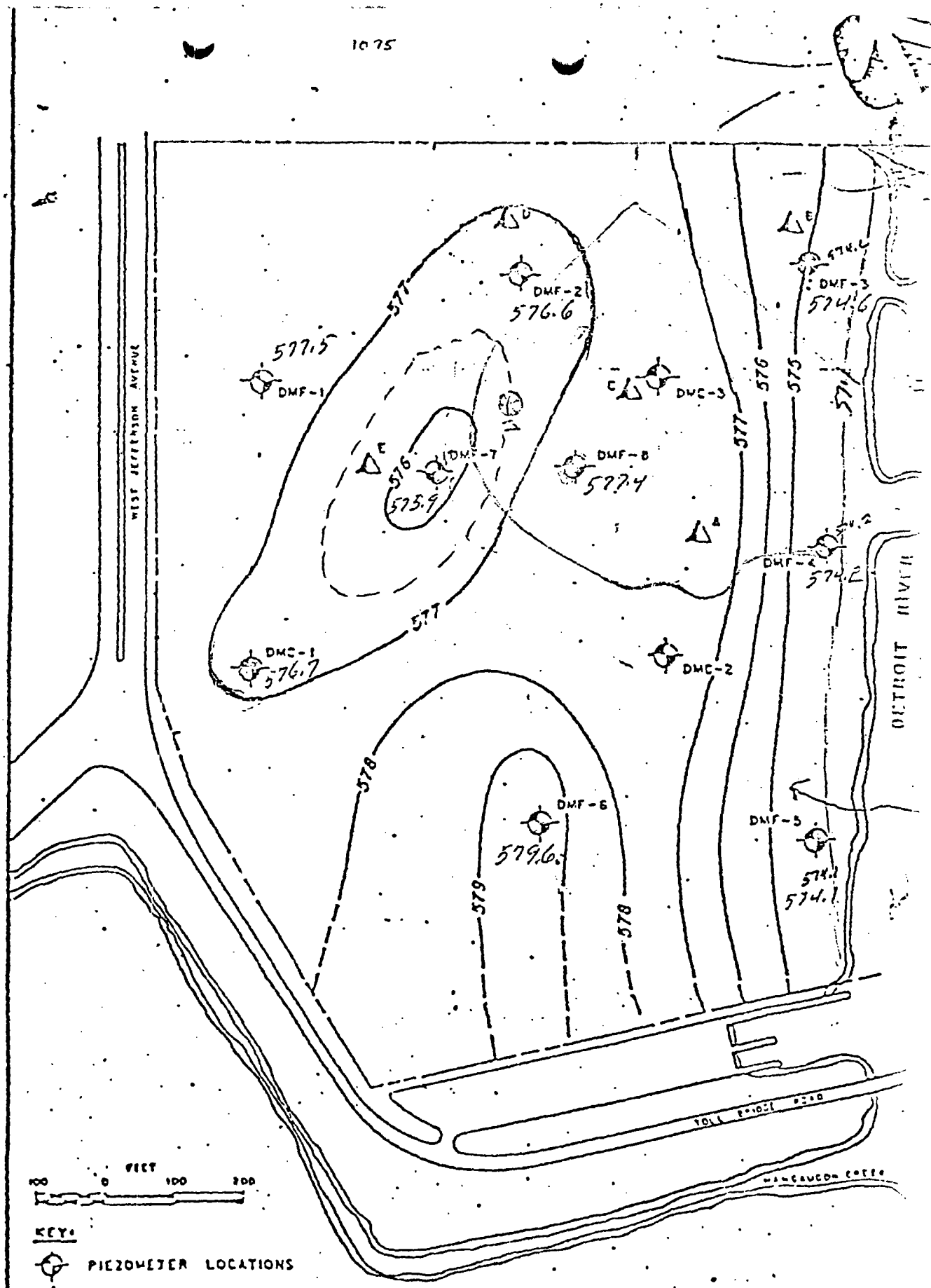

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FIGURE 5
POTENTIOMET
SURFACE (MARC
DAMES

1" = 200'

Zone of Contamination vs. Potentiometry.

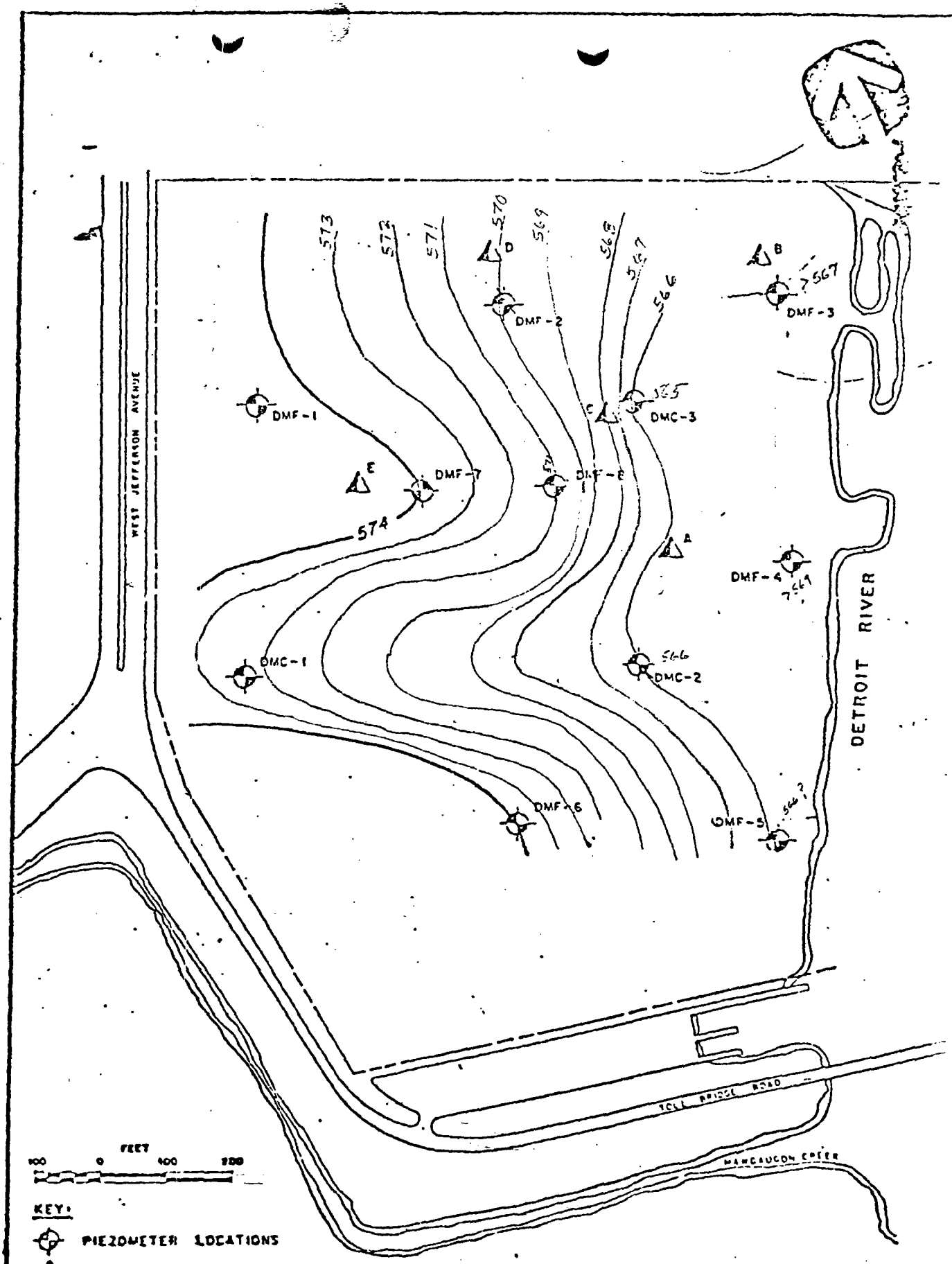

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FIGURE 4

TOPOGRAPHIC SURFAC
OF THE FILL — CLAY
LAYER INTERFACE

DAMES & MOOR

ALTERNATE
US EPA